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| 10/796,442 | 03/09/2004 | Mark T. Swihart | 19226/2282 (R-5782) | 1817 |

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08/30/2007

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| EXAMINER |
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SARKAR, ASOK K

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| ART UNIT | PAPER NUMBER |
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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|-------------------------------|--------------------------------|--|
| Office Action Summary | Application No. 10/796,442 | Applicant(s) SWIHART ET AL. | |
| | Examiner Asok K. Sarkar | Art Unit 2891 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 July 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 and 31-36 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-27 and 36 is/are allowed.
- 6) ☒ Claim(s) 28,29 and 31-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date <u>7/10/07</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on July 10, 2007 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claim 31 is rejected under 35 U.S.C. 102(e) as being anticipated by Nayfeh, US 6,743,406.

Nayfeh teaches a process for producing stabilizing photoluminescence of free silicon nanoparticles having stable photoluminescence, said method comprising:

- treating free silicon nanoparticles which are photoluminescent with a chemical oxidizer H₂O₂ under conditions effective to achieve particle surface oxidation,

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thereby stabilizing the photoluminescence of the free silicon nanoparticles (see column 5, lines 29 – 65); and

- recovering the free silicon nanoparticles that have stable photoluminescence (column 3, lines 1 – 2).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 29 and 32 – 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nayfeh, US 6,743,406 in view of Seraphin, "Influence Of Nanostructure Size On The Luminescence Behavior Of Silicon Nanoparticles Thin Films," J. Mater. Res., Vol. 12(12), p 3386 (1997).

Regarding claim 29, Nayfeh teaches a process for altering photoluminescence of free silicon nanoparticles comprising:

- acid etching the free silicon nanoparticles under conditions effective to produce free silicon nanoparticles which are photoluminescent with HF in different parts of the disclosure such as in column 2, lines 5 – 10, column 4, lines 12 – 15 and in column 4, lines 41 – 65.

Nayfeh fails to teach said acid etching is carried out for two to thirty minutes with a solution comprising hydrofluoric acid and nitric acid.

Seraphin teaches thin films of agglomerated silicon nanoparticles in which the oxide etching and regrowth were achieved simultaneously using mixture of hydrofluoric acid and nitric acid for times ranging from 60 sec with HF and about 10 min for nitric acid in pages 3386 – 3387 under the heading "Experimental Apparatus".

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Nayfeh and use a mixture of hydrofluoric acid and nitric acid to acid etch the free silicon nanoparticles under conditions effective to produce free silicon nanoparticles by judiciously adjusting and controlling the etching time during the

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etching and regrowth of the silicon nanoparticles through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) as taught by Seraphin in pages 3386 – 3387 under the heading “Experimental Apparatus”.

It would have been obvious to one with ordinary skill in the art at the time of the invention that although Seraphin applies his process to thin films of agglomerated silicon nanoparticles, the process will also be applicable to the free silicon nanoparticles produced by Nayfeh's process with predictable results.

Regarding claim 32, Nayfeh teaches hydrogen peroxide as being the oxidizer, but fails to teach oxidizer comprising nitric acid.

Seraphin teaches that thin films of agglomerated silicon nanoparticles can be chemically oxidized with nitric acid in pages 3386 – 3387 under the heading “Experimental Apparatus”.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Nayfeh and use nitric acid as the oxidizer as being chemically equivalent since both hydrogen peroxide and nitric acid are well known chemical oxidizers for silicon as taught by Nayfeh and Seraphin.

Regarding claims 33 and 34, Nayfeh fails to teach 20 – 40% nitric acid solution as being the oxidizer.

Seraphin teaches that thin films of agglomerated silicon nanoparticles which can be chemically oxidized with nitric acid either single or in combination with HF in concentration of 20 – 40% in pages 3386 – 3387 under the heading “Experimental Apparatus”.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Nayfeh and use 20 – 40% nitric acid solution for oxidizing silicon nanoparticles through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) with predictable results as taught by Seraphin in pages 3386 – 3387 under the heading "Experimental Apparatus".

8. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nayfeh, US 6,743,406 in view of Seraphin, "Influence Of Nanostructure Size On The Luminescence Behavior Of Silicon Nanoparticles Thin Films," J. Mater. Res., Vol. 12(12), p 3386 (1997) and Han, US 2004/0076813.

Nayfeh teaches a process for altering photoluminescence of free silicon nanoparticles comprising:

- acid etching the free silicon nanoparticles under conditions effective to produce photoluminescent free silicon nanoparticles which are photoluminescent with HF in different parts of the disclosure such as in column 2, lines 5 – 10, column 4, lines 12 – 15 and in column 4, lines 41 – 65.

Nayfeh fails to teach, wherein said acid etching is carried out in a solution comprising about 0.5% to 20% hydrofluoric acid and about 10% to 40% nitric acid.

Seraphin teaches thin films of agglomerated silicon nanoparticles in which the oxide etching and regrowth were achieved simultaneously using mixture of hydrofluoric acid and nitric acid of a composition of 2% HF and 48% HNO₃ in pages 3386 – 3387 under the heading "Experimental Apparatus".

Han teaches a chemical etchant to prepare silicon based photoluminescent nanoporous material in which acid etching is carried out in a solution comprising about 5% hydrofluoric acid and about 23% nitric acid solution in paragraphs 18 and 57.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Nayfe and use HF and nitric acid solution for oxidizing silicon nanoparticles and determine the concentration range through routine experimentation and optimization to achieve optimum benefits with predictable results (see MPEP 2144.05) as taught by Seraphin in pages 3386 – 3387 under the heading “Experimental Apparatus” and by Han in paragraphs 18 and 57.

Allowable Subject Matter

9. Claims 1 – 27, 35 and 36 are allowed.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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11. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Asok K. Sarkar
August 27, 2007

Primary Examiner